72-06

34.34027 -117.87244

5230

BIOLOGICAL EVALUATION

BARK BEETLE MAINTENANCE CONTROL PROJECT

ANGELES NATIONAL FOREST

JULY 1972

CALIFORNIA REGION
DIVISION OF TIMBER MANAGEMENT
BRANCH OF PEST CONTROL

FOREST SERVICE
U. S. Department of Agriculture

630 SANSOME STREET
SAN FRANCISCO, 94111

Evaluation (Insects)

5230
July 1972

BIOLOGICAL EVALUATION

BARK BEETLE MAINTENANCE CONTROL PROJECT
ANGELES NATIONAL FOREST

By
Max Ollieu
Entomologist

Bark beetle maintenance control programs have been underway in southern California since the early 1950's. Long-range insect control plans have been prepared for each Ranger District in accordance with guidelines currently located in R5 Emergency Directive No. 1, FSM 5242.22f. These control plans delineate project areas and indicate the intensity and type of treatment necessary. The control program has been approved annually by the California Forest Pest Control Action Council. The objective of maintenance control is to give the highest degree of protection feasible to recreation and timber land. The last biological evaluation was made in 1970, 1/ in which a continuation of maintenance control was recommended.

Maintenance control commenced on the Angeles National Forest in 1958. Selection tree harvest (sanitation-salvage) to reduce the amount of high risk timber and a few direct insect control projects preceded the maintenance control program.

Maintenance control has been confined to the Valyermo, Baldy and Tujunga Districts during the past few years. Most of the treated trees were located within high-use recreation sites. Trees treated from Fiscal Year 1969 are given below:

Angeles National Forest
Bark Beetle Maintenance Control Program

Fiscal Year	Trees Treated
1972	295 (est.)
1971	184
1970	124
1969	166

1/ Swain, K. M. Biological Evaluation of Bark Beetle Maintenance Control Project, Angeles National Forest, February 1970. USFS, Div. Timber Mgt., San Francisco, California. 2pp.

CAUSAL AGENTS AND HOSTS

The most important bark beetles on the Angeles National Forest are: western pine beetle, Dendroctonus brevicomis, in ponderosa pine, Pinus ponderosa, and Coulter pine, Pinus coulteri, and the California flatheaded borer, Melanophila californica, in Jeffrey pine, Pinus Jeffreyi, and ponderosa pine. Bark beetles of lesser importance include pine engraver beetles, Ips spp., and red turpentine beetle, Dendroctonus valens on all pine species; Jeffrey pine beetle, Dendroctonus jeffreyi, on Jeffrey pine; mountain pine beetle, Dendroctonus ponderosae, on sugar pine, Pinus lambertiana, and Coulter pine; and fir engraver beetle, Scolytus ventralis on white fir, Abies concolor.

LOCATION AND EXTENT OF INFESTATION

The Angeles National Forest contains 33,000 timbered acres which are divided into four Control Intensity Classes. Treated trees in the last few years have been confined to the 6,200 acres of high use Class I (continuous maintenance control) and Class II (seasonal maintenance control) priority areas (Fig. 1). Control Intensity Classes III and IV contain the remaining 26,800 acres of timber land and cover areas of lower priority. Each District has an insect control plan which shows these areas by priority.

In Fiscal Year 1972 it is estimated that 295 trees will be treated under the maintenance control program.

TYPE OF DAMAGE

There has been a persistent but fluctuating incidence of bark beetle caused tree mortality. This mortality has been low for the last few years on the Angeles National Forest, but there appears to be an upward trend in 1972. The adverse impact of tree mortality on a recreation forest is as follows:

1. Reduced esthetic value.
2. Reduced property values.
3. Increased hazard to persons and property.
4. Increased firehazard.
5. Direct monetary loss resulting from treatment or removal of dead trees.

ENVIRONMENTAL AND OTHER FACTORS

Current knowledge indicates that adverse environmental factors which injure trees or cause stress, reduce the tree's resistance to bark beetle attack. Several factors influence the current bark beetle population trend.

Moisture. Total annual precipitation fluctuates widely from year to year on the Angeles National Forest. For example, average annual precipitation for Mt. Wilson is 35 inches, but annual precipitation from 1967 to 1971 was 41, 12, 66, 38 and 19 inches, respectively. So far through April 1, 1972 0.06 inches of precipitation has been recorded at Mt. Wilson. At Big Pine 22 inches of precipitation fell in 1971, but only 0.28 inches has been recorded through April 1972.

The heaviest rainfall is normally recorded during the winter months on the Angeles National Forest. With a severe decline in moisture for 1971 and less than one inch through April 1972, the Forest is under stress from lack of moisture.

Flood Damage. Jeffrey pine along Prairie Fork of the San Gabriel River received flood damage during 1969. The stream bed widened and deepened, and consequently exposed root systems. Rocks and other debris still cover much of the valley floor.

Air Pollution. Smog (photochemical oxidants) was linked in the early 1960's with chlorotic decline of ponderosa pine in southern California. 2/ In 1969, the correlation between oxidant damage and bark beetle attack on ponderosa pine was estimated at 80 percent. 3/ However, evidence exists that some species of bark beetles (adult stage) are attracted to oxidant damaged trees, but their larvae develop poorly. Physiological changes in the phloem and cambium probably account for this brood reduction.

Recreation Use. Trampling disturbs the litter, compacts soil, plugs pores and therefore reduces intake of water and air into the soil. Excess water tends to run off instead of being absorbed and increases the risk of erosion. Mechanical damage to trees from irresponsible actions by the public also predisposes them to insect and/or disease attack.

2/ Miller, P. R., et al. 1963. Ozone injury to foliage of Pinus ponderosa. Phytopathology 53: 1072-1076.

3/ Swain, K. M. Biological Evaluation, San Bernardino, San Jacinto and Wrightwood Zones of Infestation, San Bernardino National Forest, Dec. 1971. U. S. Forest Service, Div. Timber Mgt., San Francisco, CA 13 pp.

BIOLOGICAL INFORMATION

California flatheaded borer had reached the prepupal stage in Jeffrey pine during the April visit. Some of the population was still in the larval stage.

Western pine beetle had begun emerging from ponderosa pine at Charlton Recreation Area, though pupae and callow adults were also found.

DISCUSSION

Bark beetle caused damage has been low on the Angeles National Forest during the past few years. A return of drought conditions and continued air pollution damage may be partly responsible for the current upward trend. Trees under stress are preferred for bark beetle attack.

Selection tree harvest (sanitation cutting) to remove the high risk overstory is a basic method of preventing bark beetle buildup. Where applicable, the Forest should strive to use this method. A sanitation cutting usually is effective from 8 to 12 years. The last major timber sale (Winston Springs) was completed in 1961. From cursory observation it appears that much of the timber stand in this area, from Horse Flats to Big Pines, is rapidly becoming high risk. A timber sale reconnaissance should be made to determine the feasibility of a selection cut.

Timber stand improvement through thinning and release is also an important method of preventing bark beetle buildup. Understory stands with overstocked basal areas are extremely susceptible to bark beetle attack during drought conditions. Stands of this type should be examined to determine the need for silvicultural treatment.

Logging of infested trees can be helpful in preventing attacks on additional trees. Accessible group kills in Class III areas should be handled by logging when possible. The infestation along Prairie Fork in the Valyermo District is such an area.

Bark beetle infested trees with easy access offer possible disposal through fuelwood sales. Chemical treatment of this material is not necessary if it is removed from the forest before bark beetles emergence. Success of such a program is dependent on a good District direction and coordination.

Fir engraver beetle infestations in white fir present problems in high-use areas. Evidence of attack is often difficult to locate and these attacks may not necessarily kill the tree. Consequently, chemical control of these outbreaks is not authorized unless a specific evaluation has been made by the Regional Office. However, cultural methods can be used to good advantage.

The red turpentine beetle seldom becomes a primary tree killer and is not included in the maintenance control program. Stumps should be left unsprayed when treating for bark beetles as clerid predators migrate to the lower bole to pupate. Chemical treatment of stumps to control D. valens is not authorized without a specific evaluation by the Regional Office.

RECOMMENDATIONS

The practice of evaluating bark beetle infestations has not yet developed into an exact science. Although improved tools and methods are under development for evaluation, these are not yet available, and as in the past, the need for suppression is judged primarily on the basis of tree mortality and the environmental factors affecting the area.

Four recommendations are made to help alleviate the chronic bark beetle problem on the Angeles National Forest.

1. Continue the maintenance control program.

   Considering the high recreation and property values at stake: recognizing that increasingly unfavorable environmental factors of drought, air pollution damage and fire damage will probably cause increased bark beetle damage; this is the best method available to attain minimal loss levels in recreation and urbanized forests. Maintenance control includes the following practices which should be given consideration in the following order of priority:

   (1) Sanitation (selection) cutting should be continued on National Forest land and initiated on private land where it is feasible.

   (2) Silvicultural treatment such as commercial or pre-commercial thinnings and release in overstocked stands should be continued and/or initiated.

   (3) When possible, removal of insect-infested trees should be accomplished by salvage logging or woodcutters. Be sure infested material is removed from the forest environmental.

   (4) When necessary, infested trees can be treated with a 1.5% lindane spray. Application instructions are found in R5 FSM 5240, Emergency Directive No. 1, dated May 3, 1968. Lindane applied in accordance with these instructions will have minimal adverse effects on human health, wildlife, fish or domestic animals.

   (5) The bark beetle maintenance control program only applies to those Class I and II priority areas as outlined in each District's Insect Control Plan. Special evaluations by Regional Office entomologists are required in Class III and IV priority areas.

2. A timber sale reconnaissance should be made on the Valyermo District to determine the feasibility of a selection (sanitation) harvest.

3. Chemical treatment of stumps for red turpentine beetle, D. valens, requires a separate evaluation by Regional Office entomologists. The Forest must request an evaluation if red turpentine beetle presents a problem.

4. A request for an evaluation of white fir insect problems must be made if chemical treatment is desired.

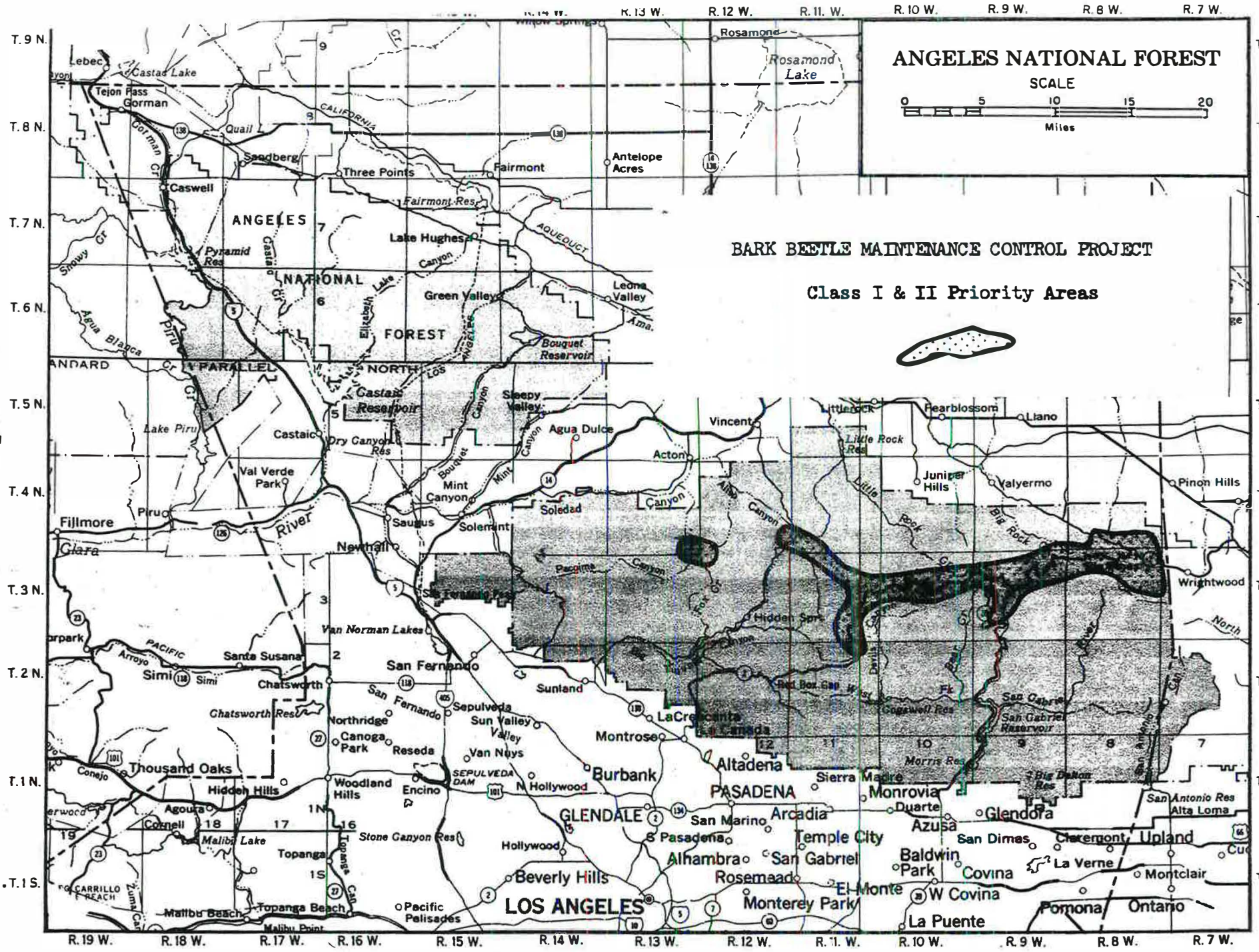

FIG. 1.--LOCATION OF BARK BEETLE MAINTENANCE CONTROL AREAS, ANGELES NATIONAL FOREST.

Evaluation (Insects)

5230
July 1972

ENVIRONMENTAL IMPACT EVALUATION
BARK BEETLE CONTROL
ANGELES NATIONAL FOREST

By
K. M. Swain and M. Ollieu

The Angeles National Forest estimates 295 trees will be treated during 1972 in control priority Classes I and II. It remains essential that these trees are treated and the infestations are not allowed to spread to other trees. Classes I and II areas encompass the high-use recreation sites on the Forest.

Different treatment possibilities are available to suppress bark beetle infestations. Each infestation must be examined and a decision made on which control action best fits the situation. For instance, a 50-100 tree infestation may provide sufficient material for a special logging contract. Fuelwood cutters offer a ready outlet for single trees or small groups. Occasionally, numerous small diameter trees infested with bark beetles might be cut, piled and burned more efficiently and economically than by other control methods.

Often existing conditions preclude removal or burning of infested material, but control is still desired. In such cases, chemical treatment may be the best alternative. Lindane mixed in diesel fuel, which is registered for this use, is recommended in Region 5 for chemical treatment of bark beetles. The following environmental impact evaluation discusses the effect of lindane on the environment and alternative control actions.

I. ENVIRONMENTAL IMPACT

Lindane spray will be applied in low dosages to individual felled trees. Lindane-diesel oil forms a tissue deposit (no lindane on bark surface), so environmental contamination will be kept to a minimum. One of the major concerns of organochlorine compounds, such as lindane, is that it may be transferred in the food chain through a phenomena called biological magnification. Dr. Francis Gunther (personal communication, Branch of Pest Control, Region 5), Chemist and Toxicologist, at the University of California (Riverside) stated that he knew of no instances where lindane went through biological magnification. Dr. Gunther is the editor of the 1970 edition of Residue Reviews and a renowned authority on insecticides. Macek (1970) said that lindane and methoxychlor would not be expected to be biologically magnified to any great degree.

A. Air

Lindane is stable to air, light, heat, and carbon dioxide. (Martin, 1968) No air pollution should occur through treating felled trees with a lindane-oil solution.

B. Natural Beauty

Much of the area is visible from roads, trails, and overlooks. Because of the small number of trees to be felled the visual impact will be negligible. Slash created by insect control work will be handled in a manner that is consistent with the objectives of the Ranger District Multiple Use Plans and the Sub-Regional Guidelines. The removal of sorrel, and red-top trees from near and distant view areas will enhance the natural beauty, not detract.

C. Range and Plant Life

Lindane is considered to be nonphytotoxic at insecticidal dose levels.

D. Soils

With proper application procedures, very little of the lindane-oil solution should reach the soil. Lindane is moderately stable in soil but is fairly resistant to removal from the site of application by physical factors. (Lichenstein, 1959) Also, lindane degrades in soil to pentachlorocyclohexene (PCCH) which is more volatile than lindane, and does not remain in the soil to any extent. (Guenze, 1970)

E. Water

There are numerous small streams throughout the area. However, no infested trees will be felled in or across streams. All felled trees will be removed to at least 50 feet from any body of water. Lindane has very little movement in the soil, hence, there should be no effect on water quality or stream flow.

F. Fish and Wildlife

With the low dosage and direct application only to the bark of felled trees, no effect on fish and wildlife is expected. Keeping away from streams is mandatory.

Fish. Generally most insecticides are toxic to fish. The chlorinated hydrocarbons are particularly toxic. However, lindane is considered to be one of the safer chlorinated hydrocarbons. (O'Brien, 1967)

Brown and rainbow trout were all killed by exposure to 0.05 ppm of lindane, but bluegills have survived 0.45 ppm of 12 percent lindane. However, bass and bluegill fingerlings suffered 50 percent mortality at 0.1 ppm of the same formulation. (Rudd, 1956) Four species of fish were exposed to water containing 0.03 ppm lindane. Two days after termination of exposure, the fish had eliminated 90 percent of the lindane. (Gakstatter and Weiss, 1967)

Birds. Numerous tests have been made feeding various birds on a diet of certain percentages of lindane. A 10 percent mortality of pheasants resulted from eating grain treated with one and two-thirds ounces of 75 percent lindane per 100 pounds over a 20-day period. However, other investigators were unable to detect noteworthy changes in the bird population of a 40 hectare pasture and woodland treated with 10 percent BHC (10 percent gamma) at approximately 50-70 pounds per acre. This application is about twice that normally employed. In addition, considerable field observation and experimentation in Germany have led essentially to the same conclusion. The small amounts of BHC that a wild bird could ingest would be insufficient to cause harm, due to the rapid disintegration of the material (BHC) within the animal body. (Rudd, 1956)

In summary, the National Academy of Sciences (1969), indicates that field applications of lindane have no toxic effect on birds.

Animals. The chronic toxicity of BHC, with the exception of the beta isomer (this isomer not in lindane) is relatively low. Technical BHC and lindane have been rated as one half and one quarter, respectively, the toxicity of DDT. Minimal storage, rapid elimination from the body and lesser degree of tissue damage are the criteria for this rating. (Lehman, 1950)

According to the National Academy of Sciences (1969) mammals metabolize lindane quite rapidly to trichlorobenzenes and phenols, which are excreted, and thus accumulate very little in the body fat. Hence, in mammals it has a low oral toxicity. (O'Brien, 1967)

G. Man

The U. S. Department of Health, Education and Welfare reports that there have been no confirmed cases of systemic poisoning in man as a result of repeated exposure to BHC (comparable to lindane). A Roumanian study showed no ill effects from massive inhalation of DDT plus lindane in a forest spraying operation; some workers inhaled 21 mg/kg of DDT as well as 6 mg/kg of lindane daily for 30 days. (O'Brien, 1967) Lindane is absorbed through the skin and other portals. Lindane has the highest mammalian toxicity but is also rapidly excreted by the kidneys and hence does not accumulate extensively. It therefore has the lowest toxicity on repeated dosages. (Hayes, 1963)

H. Wilderness Areas

There are no wilderness areas in the project.

II. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

A temporary reduction of certain beneficial and associated insects as well as some soil arthropods is probable. Two common predators of the western pine beetle, Enoclerus lecontei and Temnochila chlorodia, are quite easily killed by lindane. (Swain, 1968)

III. ALTERNATIVES TO THE PROPOSED ACTION

A. Log Infested Trees

This method is very desirable; however, it is extremely difficult to remove all of the infested trees before bark beetle emergence. Also, recreation and heavily urbanized areas are usually not suitable for logging. However, this method should be used whenever possible.

B. Removal of Infested Trees by Woodcutter

Usually only a small number of trees can be handled in this manner as it is difficult to remove the trees before insect emergence. Another problem is that the infested material must be removed from the forest environment otherwise control is not accomplished. Hence, this precludes the use of local woodcutters.

C. Fell, Peel and Burn Infested Trees

The fire hazard in southern California generally will not permit this type of treatment. Also the effects of charred debris and scorched vegetation is undesirable in most of the areas. Unfortunately, in most areas local Air Pollution Control Board ordinances prohibit burning.

D. Use Ethylene Dibromide Instead of Lindane

Ethylene dibromide is a fumigating insecticide and has limited effectiveness, particularly in cold weather. Because of its short residual qualities, it may not render the uninfested portions of treated trees toxic to slash-breeding insects. Ethylene dibromide poses a greater hazard to treatment crews than does lindane as it is notorious for causing skin irritations resulting from direct contact. Breathing its fumes may cause lung irritation.

E. Discontinue Insect Control Work in the Area

This should be regarded only as a theoretical alternative as it would have an intolerable adverse effect on the land value and the forest resource that people value for temperature modification, recreation, esthetics, shade and timber production.

IV. IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

There are no irreversible commitments except the finality of cutting a tree which would soon become a snag. Some snags always remain for wildlife habitation. Also, tree regeneration may take place in areas where trees have been cut.

V. CONSULTATION WITH OTHERS

On a special and continuing basis there has been consultation with State agencies, Universities, other Federal agencies, and local review through the District Ranger and Forest Supervisor.

REFERENCES CITED

Anon. 1969. National Academy of Sciences. Insect-Pest Management and Control.

Gakstatter, J. H. and Weiss, C. M. 1967. The uptake from water by several species of fish of DDT, dieldrin and lindane; their tissue distribution and elimination rate. Amer. Fish Soc, Trans. 96:301-306.

Guenze, W. D. and Beard, W. E. 1970. Volatilization of lindane and DDT from soils. Soil Science Society of American Proceedings. May/June.

Hayes, W. J., Jr. 1963. Clinical Handbook on Economic Poisons.

Lehman, A. J., Hartzell, A., and Ward, J. C. 1950. Effects on beneficial forms of life, crops, and soil and residue hazards. Jour. Amer. Med. Assoc. 144:104-108.

Lichtenstein & Shultz. 1959. Breakdown of lindane and Aldrin in soils. J. Econ. Entomol. 52(1): 118-124.

Macek. 1970. The Biological impact of Pesticides in the Environment. Environmental Health Science Series #1, Oregon State University Press.

Martin, Hubert. 1968. Pesticide Manual. Brit. Crop Protec. Counc.

O'Brien, R. D. 1967. Insecticides - Action and Metabolism, Academic Press.

Rudd, Robert L., and Genelly, Richard E. 1956. Pesticides: Their Use and Toxicity in Relation to Wildlife, Game Bulletin No. 7, Department of Fish and Game.

Swain, Kenneth M. 1968. Protecting Ponderosa Pine from Bark Beetle Attack Using Lindane-Water Emulsion Spray. Forest Service, USDA. Division of Timber Management, San Francisco, California (unpublished).

Thompson, W. T. 1967. Agricultural Chemicals Book I. Insecticides. Thompson Publ: Davis, California.

Evaluation (Insects)

July

COST-BENEFIT EVALUATION
BARK BEETLE CONTROL
ANGELES NATIONAL FOREST

By
Max Ollieu

Each District has on file an Insect Control Plan which discusses the bark beetle maintenance control plan by District. Priority Classes I and II in the Insect Control Plan encompass areas where continuous and seasonal maintenance control action will be taken. Abnormal buildups of bark beetle population outside these classes require additional evaluations.

RESOURCE VALUES

The Angeles National Forest lies almost entirely within Los Angeles County and offers the closest proximity to National Forest land for the greater Los Angeles populace (Fig. 1). Timbered portions of the National Forest cover less than 5% of the land (33,000 of 691,000 acres) and are confined to the higher elevations. An extensive system of developed picnic grounds and campgrounds is offered and maintained by the Forest. There are a total of 25 picnic grounds and 89 campgrounds, of which six are available only to larger groups. Recreation use in 1971 was 3,924,600 visitor days.

Timber harvest has been minimal on the Angeles National Forest. Logging has been confined to fire salvage and selection tree harvest which removes high risk overstory. The last sale was on Tujunga District which removed 600 MBF from the Mt. Gleason area during 1969-70. The Arroyo-Seco and Valyermo Districts completed the 14,000 MBF Winston Springs sale in 1961. These comprise the last two timber sales on the Angeles National Forest.

SUPPRESSION COSTS

The cost for chemical treatment of bark beetle infested trees has run approximately $25.00 per tree on both the Angeles and San Bernardino National Forests. An estimated 295 trees will require treatment on the Angeles National Forest during Fiscal Year 1972. Therefore, suppression costs should reach $7,375.